ART. I.—*On Ozone.* By R. L. J. ELLERY, ESQ., President of the Royal Society.

[Read 12th February, 1866.]

Many years ago Schönbein, of Basle, discovered the peculiar principle which is now known as Ozone; its chemical and physiological relations have been ably studied by that sagacious philosopher ever since, as well as by Andrews of Belfast, Tait, de la Rive, Becquerel, Baumert, and others, and although much mystery still envelopes the nature of this body and its effects, there is yet a large amount of evidence and experience concerning it, which, as far as I am able, I propose to lay before this Society. The general interest which attaches to ozone is, I conceive, principally due to the belief that it frequently forms a constituent of our atmosphere, and has a special influence in the animal economy, and, although it is questioned that this has been satisfactorily proved, there are few scientific men who venture to deny it. The want of satisfactory or absolute proof is owing, for the most part, to the difficulty of obtaining pure and free ozone in quantities sufficient for analysis and experiment, or in devising tests for its presence, which shall be incapable of being influenced in the same way by any other body as by ozone; but it will be useful to work as well as possible with the means at our command. I, therefore, propose to consider Ozone *that principle* present in our atmosphere which gives the reaction on iodide of starch papers known as ozone tests. For whether the reaction be due to ozone and ozone only, or not, or whether some more or less frequent reactions may not be due to nitric acid or some other highly oxydizing agents, will not matter, since the same physiological effects appear to be the result whenever the reaction happens. Much difference of opinion has at various times been entertained concerning the nature of this body. Schönbein at first considered it to be a peroxyde of hydrogen (HO_2) in the vaporous state. Baumert has recently suggested HO_3 as the

probable formula; but it has since been shown by Dr. Andrews (see his paper on Ozone in *Philosophic Transactions*, Vol. 146, Part I.) that hydrogen *cannot* form part of it. He sums up his elaborate researches with these words:—"Ozone, from whatever source derived, is one and the same body, having identical properties and the same constitution, and is not a compound body, but oxygen in an altered or allotropic condition." This view of the nature of ozone is the one, I believe, now generally adopted.

According to Dr. Apjohn, "Ozone is a gas of a peculiar odour, hence its name (ὀζω, *I smell*) having some resemblance to that of chlorine, diluted with much atmospheric air." Its specific gravity, according to Tait and Andrews, is four times that of oxygen, or taking air as 1·000, it is 4·4224. It possesses the greatest oxydating power of any known body, as at ordinary temperatures it destroys vegetable colours, corrodes organic structures, and powerfully oxydizes most metals. Like all other active oxydating agents, it decomposes iodide of potassium, and sets the iodine free, and this fact is used for the ordinary test for the presence of ozone. Free iodine dyes starch an intense blue; therefore, strips of chemically pure paper, dipped in a mixed solution of iodide of potassium and starch and dried, when exposed to ozone and then moistened, turn blue, with a greater or less intensity, according to the quantity present. Although this test is liable to similar reactions with several other substances, it has been found the most useful and certain, and is generally adopted.

Ozone can be produced artificially in many ways: by passing sparks of electricity through atmospheric air, or better through oxygen; in the decomposition of certain aqueous solutions by electrolysis; by the slow oxydation of phosphorus, ether, turpentine, &c., at common temperatures in atmospheric air; and by decomposition of permanganate of potash. The peculiar odour observed during electric discharges, especially of frictional electricity, is due to the ozone evolved. For experimental purpose the phosphorous and permanganate of potash modes are generally adopted. The evaporation and consequent oxidation of ether, however, appears, both from experiments of my own, and from a long series of observations of my friend, Dr. John Day, of Geelong, to be a very convenient method of ozonizing air. The effect of ozone, or ozonized air, on animal life, has formed the subject of investigation by many chemists and physiologists.

In 1851, Schönbein communicated to the Medico Chirurgical Society of London the fact that the inhalation of highly ozonized air caused a painful irritation of the lungs, a kind of asthma, attended with a violent cough. Schönbein, Schwartzenbach, Böckels, Desplats, and others, found that animals compelled to breathe strongly ozonized air died from affections of the respiratory organs, though Schwartzenbach considered the pulmonary symptoms were secondary, and that it was the nervous system that was directly attacked. Dr. W. Ireland, in the Edinburgh *Monthly Medical Journal* for February, 1863, states, as the result of his experiments:

1st. That ozonized air accelerates the respiration. 2. That it excites the nervous system. 3. That it promotes the coagulability of the blood, probably by increasing its fibrine. 4. Animals can be subjected to the influence of a considerable proportion of ozone for hours without permanent injury, but prolonged exposure always proves fatal.

Dr. Day, of Geelong, who has for several years closely studied the subject, more especially in connection with the prevalence of epidemics, and most especially diphtheria, informs me he has on several occasions subjected animals to air ozonized by ether, and that they always appeared to suffer from pulmonic disturbance. He told me that frequently, while experimenting with ozonized air, he has been attacked (to use his own words) with a "most delightful sore throat." On the other hand, it is stated, that in Algeria, where bronchial and lung affections are rare, the atmosphere generally contains a pretty full amount of ozone. The prevalence of cholera and other diseases of the alimentary system have been by many attributed to a deficiency of ozone in the air. This fact has not been corroborated by some experimenters; nevertheless, that the excess or defect of ozone in the atmosphere has some effect on the animal economy, more especially in weakened or diseased subjects, cannot be doubted. Further investigation, with a patient gathering together of statistics, will, I feel sure, be rewarded by a yet clearer trace of this mysterious influence. Years ago my attention was attracted by the marked changes produced in invalids, especially in those suffering from affections of the mucous membranes, by the sudden and great accession of ozone we sometimes get here when the wind, after blowing from the N. in summer for many days, suddenly shifts to the S.W. and S., more especially when accompanied by rain. I have

further noticed that when we get a high ozonic reaction over any extended period, that influenza has frequently been prevalent, and that a continued easterly wind, when ozone is always at its ebb here, is marked by a lowering of the tone in the system, indicating, perhaps, that a moderate amount of ozone is requisite to fully vitalize the blood. A systematic and continued course of comparison between the ozonic reaction and the prevalence of certain diseases, and especially the changes in such diseases, would, I think, be of good value. The meteorologist and experimenter should co-operate with hospital surgeons and physicians, and with the health officers of towns; the deductions that could be made after some years, perhaps months, of such co-operation could not fail to add much to our knowledge of the courses of disease, and perhaps to their prevention.

The power of ozone as a disinfectant and deodorizer is greater than that of any known body, and many plans are now proposed for ozonizing the air of hospitals and other places of like kind. The slow evaporation of water produces ozone in very small quantities; hence, the methods of adding aqueous evaporation to ventilation schemes is highly beneficial. But a larger supply would be necessary to effect the required purposes in some hospital and asylum wards, and therefore the mode of ozonizing air by the decomposition of ether would be the best.

I have been quite surprised at the effect of evaporating ether in ozonizing air, and of the powerful deodorizing action it produces. Dr. Day informs me that, in cases of necrosis, by the occasional sprinkling of a few drops of ether on the bandages, the dreadful stench which attends this bone disease is entirely obviated; and I believe a room could be ozonized to any extent by occasionally diffusing a few drops of ether by means of one of the perfumed jets, or by a fluid pulverizer.

To show the effect of sulphuric ether in producing ozone, I will just put a strip of Schönbein's test into a beaker, and then drop in a drop or two of ether. The paper has the full reaction in a few minutes. Appended to this paper are a series of observations extending over a period of about five years, namely, from March 1858, to December 1863. The results are given so as to show—

1st. The relation, if any, there may exist between the electric and ozonic condition of the air.

2nd. The amount of ozone registered at Melbourne, as

compared with Ballarat, Sandhurst, and Beechworth, in 1858.

3rd. The reaction in different seasons, and for day and night, in Melbourne, with other deductions. And a table showing the dates of the maximum of ozone with the state of weather which accompanied it; also, the dates of the minimum of ozone with the state of weather.

As regards the first part of the tables, namely, the relation of electricity to the presence or otherwise of ozone, no connection can be traced with any certainty during heavy rains. We certainly frequently get a maximum of ozone and a minimum of negative electricity, but this is not always the case.

From the second table, it will be perceived, that Melbourne has a less ozonized atmosphere than either of the three inland towns. This may be due by some means to the littoral position of Melbourne.

The third part shows, as does the preceding table, that most ozone is present at night at all four localities, and that there is more present in autumn and winter than in spring and summer. The tables of maximum and minimum clearly indicate that we get most ozone in Melbourne with wind from W., S.W., and S., especially with rain, and the least with the wind from S.E., E., N. The most occurs with S.W. wind.

I propose on an early occasion to supplement this paper with the results of our more recent observations and experiments, and if possible with some comparisons with the sanitary condition of the neighbourhood of Melbourne.

MEAN MONTHLY AMOUNT OF OZONE AND ELECTRICITY FOR THE FOLLOWING YEARS AND THE WHOLE PERIOD.

Months.	1858.					1859.					1860.					1861.					1862.					1863.					Mean for the Period.				
	Ozone, Mean of		Electric Tension.			Ozone, Mean of		Electric Tension.			Ozone, Mean of		Electric Tension.			Ozone, Mean of		Electric Tension.			Ozone, Mean of		Electric Tension.			Ozone, Mean of		Electric Tension.			Ozone, Mean of		Electric Tension.		
	Day.	Ngt.	Mean of Pos.	No. of Hours of Registration. Neg.	0	Day.	Ngt.	Mean of Pos.	No. of Hours of Registration. Neg.	0	Day.	Ngt.	Mean of Pos.	No. of Hours of Registration. Neg.	0	Day.	Ngt.	Mean of Pos.	No. of Hours of Registration. Neg.	0	Day.	Ngt.	Mean of Pos.	No. of Hours of Registration. Neg.	0	Day.	Ngt.	Mean of Pos.	No. of Hours of Registration. Neg.	0	Day.	Ngt.	Mean of Pos.	No. of Hours of Registration. Neg.	0
			pts.					pts.					pts.					pts.					pts.					pts.					pts.		
January ...	—	—	—	—	—	2·78	3·18	2·73	53	81	2·90	4·22	2·23	96	98	3·03	3·71	2·19	98	54	—	—	3·25	35	18	3·28	4·85	—	—	—	3·01	3·99	2·60	71	63
February...	—	—	—	—	—	2·27	3·32	2·67	76	77	2·63	4·35	2·21	124	113	3·67	5·52	1·23	37	172	—	—	2·95	43	54	3·80	5·71	—	—	—	3·09	4·73	2·27	70	104
March ...	3·32	4·17	—	—	—	2·68	3·36	2·72	57	61	3·57	4·17	2·39	49	72	2·50	3·91	1·31	38	183	3·65	4·72	2·44	19	40	3·64	3·14	—	—	—	3·23	3·91	2·22	41	89
April... ...	3·90	4·17	—	—	—	3·48	4·33	2·99	54	28	4·45	5·04	2·43	26	71	3·93	4·81	1·98	11	73	4·72	5·57	2·65	17	43	3·47	3·21	—	—	—	3·99	4·52	2·51	27	54
May	3·98	3·75	2·70	20	75	3·79	4·75	3·03	21	33	4·41	4·84	2·44	42	51	3·52	4·90	2·25	17	66	4·41	5·68	3·61	31	34	4·56	4·50	—	—	—	4·11	4·74	2·81	62	52
June	2·62	3·71	3·27	15	46	5·67	6·73	3·70	23	27	4·88	5·79	3·77	16	46	—	—	3·17	23	24	5·11	5·99	3·34	16	63	2·72	3·52	—	—	—	4·20	5·15	3·45	19	41
July	4·17	4·56	2·53	14	99	5·56	5·77	4·32	21	23	5·76	6·07	5·41	14	11	—	—	4·06	11	54	5·96	6·91	2·21	16	56	5·10	6·28	—	—	—	5·31	5·92	3·71	15	49
August ...	3·48	3·95	2·79	25	60	5·13	5·67	3·56	44	22	5·07	5·87	4·29	10	29	—	—	4·33	23	28	5·41	6·35	2·96	39	41	6·90	6·42	—	—	—	5·20	5·65	3·59	28	36
September	3·00	4·27	3·01	40	47	5·34	6·41	4·15	57	27	4·27	5·48	3·36	66	63	—	—	3·60	39	26	—	—	—	—	—	5·61	5·69	—	—	—	4·56	5·46	3·53	51	41
October ...	2·44	3·62	2·93	65	68	4·74	6·25	3·66	46	43	4·34	6·17	2·52	43	84	—	—	3·24	61	15	4·55	6·09	—	—	—	4·63	5·00	—	—	—	4·14	5·43	3·09	54	53
November	3·00	4·11	2·42	48	107	3·50	6·28	2·46	52	84	3·35	3·97	2·30	68	73	—	—	3·24	51	18	3·64	5·38	—	—	—	4·64	4·50	—	—	—	3·63	4·85	2·61	55	71
December	2·60	3·16	3·12	69	70	2·34	3·97	2·90	74	66	3·28	4·20	1·87	77	110	—	—	2·52	42	48	3·14	5·37	—	—	—	3·61	4·24	—	—	—	2·99	4·19	2·60	66	74
Means and Sums for the Year	—	—	—	—	—	3·96	5·02	3·25	578	572	4·07	5·02	2·95	631	821	—	—	2·77	451	761	—	—	—	—	—	4·33	4·75	Means for the period			3·96	4·88	2·92	559	727

COMPARATIVE TABLE OF MEAN AMOUNT OF OZONE AT DIFFERENT STATIONS.

MONTHS.	MELBOURNE.		BALLARAT.		SANDHURST.		BEECHWORTH.	
	Day.	Night.	Day.	Night.	Day.	Night.	Day.	Night.
1858.								
March	3·32	4·17	—	—	1·1	2·1	2·2	4·4
April	3·90	4·17	—	—	2·4	4·2	3·2	5·2
May	3·98	3·75	—	—	5·2	7·3	5·8	7·7
June	2·62	3·71	5·5	5·7	6·9	7·9	5·9	7·7
July	4·17	4·56	6·0	7·7	7·3	9·0	5·7	7·6
August	3·48	3·95	5·8	7·1	5·7	7·5	5·9	7·2
September	3·00	4·27	5·3	7·0	5·3	7·5	6·5	8·0
October	2·44	3·62	3·7	5·4	2·0	5·0	3·8	5·0
November	3·00	4·11	3·8	5·1	2·7	5·9	2·9	4·8
December	2·60	3·16	3·2	4·7	2·3	4·9	2·9	4·5
1859.								
January	2·78	3·18	3·4	5·1	2·0	3·7	4·0	5·0
February	2·27	3·32	3·8	5·3	—	—	1·0	4·0
Means	3·12	3·83	—	—	—	—	4·17	5·95

For Melbourne it was found that the ozonic reaction is smaller with east winds, slightly increases with N. and N.W. winds, and reaches its maximum when the wind blows from S. W. towards the east, gradually decreasing again.

With regard to the seasons, and day and night, the amount of ozone shows, with Schoenbein's test paper—

OZONIC REACTION

QUARTER.	DAY.	NIGHT.	MEAN.
Spring	2·81	4·00	3·40
Summer ...	2·55	3·22	2·88
Autumn ...	3·73	4·03	3·88
Winter	3·55	4·19	3·87
Year ...	3·16	3·86	3·51

There seems also a distinct variation throughout the day in the amount of ozone, in addition to that already shown by the day and night registrations.

Papers exposed during six hours give—

Between 6 a.m. and noon	1·59
„ noon and 6 p.m.	1·63
„ 6 p.m. and midnight	1·58
„ midnight and 6 a.m.	1·70

It appears that between the hours of 6 and 9 p.m. the amount is least, between 6 and 9 a.m. greatest.

The electric tension for the seasons is as follows—

QUARTER.	MEAN TENSION.	MEAN NO. OF REGISTRATIONS.	
	Positive Electricity. Parts.	Negative Elect.	No Elect.
Spring ...	3·12	159	186
Summer ...	2·64	242	248
Autumn ...	2·89	117	153
Winter ...	3·40	71	148
Year ...	3·01	589	735

The positive tension, being the normal state of atmospheric electricity, assumes its smallest value in the months of February and November, and its highest in the months of June and September, the range in the monthly mean amounting to 1·17 parts of division.

The electric tension is chiefly negative during hot winds, when clouds of dust are floating in the air, and during heavy rain; in the latter case the negative tension is frequently so great that vivid sparks may be obtained from the instrument.

The collation of the observations on the tension of positive atmospheric electricity gives the following results with regard to the means for the even hours throughout the year, showing a daily amplitude of two to three parts of division, the turning points of the same being at 8 h. a.m. and 3 h. p.m.

Midnight ...	2·97	Noon ...	2·13
2 h. a.m. ...	2·54	2 h. p.m. ...	2·72
4 h. „ ...	2·64	4 h. „ ...	1·92
6 h. „ ...	3·41	6 h. „ ...	3·03
8 h. „ ...	4·17	8 h. „ ...	3·52
10 h „ ...	2·84	10 h. „ ...	3·36

CASES OF MINIMUM OZONE,

Registered during 12 *hours' exposure, with attendant State of the Weather.*

Date.	Day or Night.	Amount.	Direction of Wind.	General State of the Weather.
1863.				
Jan. 1	Day	1.0	Wly.	Boisterous and cloudy.
2	,,	2.0	S.Wly.	Fine and pleasant; in the afternoon wind unsteady between S. and S.W.
6	,,	2.0	S.E., S., and S.W.	Fine and clear, and rather squally.
7	,,	1.0	N.Ely.	Fine and clear; warm wind; dense haze all round.
8	,,	0.5	Nly.	Hot wind; dense haze all round (like smoke).
8-9	Night	1.5	Nly.	Boisterous, squally; clear.
10	Day	2 0	S. and S.S.W.	Strong, cool breeze; dense haze all round horizon.
12	,,	1.0	S. and S.S.W.	Fine and pleasant, light squalls; dense haze all round.
16	,,	1.0	W., S.S.W. and S.	Cool and pleasant day; sky frequently changing.
17	,,	2.0	S.S.W. and S.	Fine, though rather cloudy.
17-18	Night	2.0	S.S.E. and E.	Cloudy during evening; after midnight clear.
18	Day	1.0	W., S.W., and S.	Fine and pleasant; strong wind towards the afternoon between S.S.E. and S.S.W.
21	,,	2.0	Variable and light, S. predominating	Beautiful weather, but very sultry.
21-22	Night	1.0	Nly.	Fine and clear and sultry; lightning all the evening, heavy gusts after midnight.
22	Day	1.0	N. until noon, after that S. and S.W.	Fine and clear, and very close.
27	,,	2.0	S. and S.W.	Dull and gloomy, clearing up towards the afternoon.
27-28	Night	1.0	S.S.E. and E.	Pleasant calm night; sky overcast.
28	Day	1.0	S.E. and S.S.W.	Fine, but cloudy, and sky very changeable.
31	,,	1.0	Variable and light, Sly. predominating	Calm, clear day; dense haze all round.
Feb. 1	,,	1.0	Nly.	Hot and calm, and very clear.
1-2	Night	0.0	N. and N.E.	Fine and clear, with heavy gusts of wind.
2	Day	2.0	N. and N.N.W., veering to S.W. at 5.32 p.m.	Hot wind and much dust; threatening clouds in S. at 5 p.m.
6	,,	1.0	S.W. and S.	Dull and cloudy; at 11 a.m. clearing off, afternoon fine and clear.
7	,,	2.0	E., S.E., and S., very light	Calm, dull day; dense haze all round.
10	,,	0.5	W., S.W., and S., very light	Dull, gloomy; at 11 a.m. clearing off fine.
12-13	Night	2.0	S.S.E. and calm	Very fine and clear, with heavy dew.
13	Day	1.0	S.S.W., very light	Fine and very hazy.
14	,,	2.0	S. and S.S.W., very light	Close and sultry; dense haze all round.
22	,,	1.0	N.E., and at noon veering round to S.W.	Fine, clear, and pleasant.
22-23	Night	1.0	N., N.W., and calm	Pleasant evening; towards early morning (3 a.m.) light rain.
Mar. 4	Day	0.5	S.S.W. and Ely., N. very light	Fine and clear day; lightning all evening.
5	,,	1.0	N.E., E., and calm	Warm, close day; distant thunder and lightning during the evening.
8	,,	1.0	W., S., and S.E.	Very fine weather; strong, cool breeze.
12-13	Night	0.5	S.E. and E., light	Fine and clear, getting overcast towards morning; heavy dew during night.

CASES OF MINIMUM OZONE—(*Continued*)

Date.	Day or Night.	Amount.	Direction of Wind.	General State of the Weather.
1863.				
Mar. 18-19	Night	0.5	Wly., S., and N.Wly., light.	Rain showers during evening.
20	Day	1.0	Calm, S. and E.	Fine and clear.
24	,,	1.0	N.Ely.	Fine and clear.
24-25	Night	1.0	N.Ely.	Fine and clear.
25	Day	0.5	N. and N.E.	Fine and clear.
28-29	Night	1.0	Calm and N.E.	Fine and clear; heavy dew.
29-30	,,	0.5	N.Ely.	Fine and clear; heavy dew.
30-31	,,	1.0	Calm	Fine and clear; heavy dew.
April 6-7	,,	1 0	N. Ely and calm	Fine and clear; heavy dew.
7	Day	1.0	Nly.	Fine and clear.
8	,,	1.0	N. and N.N.E.	Fine and clear.
8-9	Night	1.0	N.N.E. and E.N.E.	Fine and clear; heavy dew.
9	Day	1.0	N.E., S.W. and calm, very light	Fine and clear.
10	,,	1.0	N.Ely	Fine and clear.
12	,,	1.0	N.E. and Sly., light	Fine and clear.
13-14	Night	0.5	Calm	Fine and clear, with heavy dew during evening; fog after midnight.
14-15	,,	0.5	Calm and N.E.	Fine and clear, with heavy dew.
15	Day	0.5	Variable and light	Fine and clear, and sultry.
16-17	Night	0-5	S.S.W. and W., light	Rain showers after 10 p.m.; sheet lightning during evening.
20	Day	0.5	N.E., S., and N., very light.	Fine and pleasant.
20-21	Night	0.5	N.Ely.	Fine.
21	Day	0.5	Variable and calm	Fine and pleasant.
21-22	Night	0.5	N.Ely.	Fine.
22	Day	0.5	Variable and calm	Fine and clear.
May 1-2	Night	0.5	N. Ely.	Fine and clear.
9	Day	1.0	Variable and calm	Fine and clear.
11	,,	1.0	N.E. and Sly., very light	Fine.
June 1	,,	1.0	Variable and calm	Fine and pleasant; foggy atmosphere.
1-2	Night	0.5	Calm	Heavy fog.
2-3	,,	0.5	Calm	Heavy fog.
4	Day	0 5	Ely. and calm	Dull and foggy.
7-8	Night	1.0	N.Ely.	Fine and clear during evening, with heavy dew; overcast towards morning.
10-11	,,	1.0	Calm and N.E.	Foggy.
11	Day	0.5	N. and N.E.	Fine and mild; very hazy.
12	,,	0.5	N.E. and E.	Fine; dense haze.
13	,,	0.5	Calm	Very foggy.
13-14	Night	1.0	Calm	Very foggy.
14	Day	0.5	S.W. and S., light	Fine and pleasant.
15-16	Night	0.0	N.Ely.	Fine during evening; dull towards morning, with light rain and heavy mist all round.
16	Day	1.0	Nly.	Boisterous, with heavy, threatening sky.
18	,,	1.0	Nly.	Fine and mild.
18-19	Night	0.0	Calm and N.E.	Very fine, with heavy dew.
19-20	,,	1.0	Calm and N.E.	Very foggy.
20	Day	1.0	E. and Nly.	Foggy, but fine.
26	,,	1.0	Calm and N.E.	Dense fog.
27	,,	0.0	Calm and variable	Dense fog.
27-28	Night	1.0	E. and N.E., light	Very foggy.
28	Day	1.0	N. and N.E.	Fine and clear.
30	,,	1.0	N. and W.S.W.	Scattered rain at 10 a.m.; fine afternoon and boisterous; toward evening foggy.
July 12-13	Night	1.0	N.N.W. and calm	Dull, but fine; fog after 6 a.m.
Aug. 12-13	,,	1.0	E. and N.E.	Fine and clear; ice and hoarfrost.
14-15	,,	1.0	Calm and N.E.	Fine and clear; hoarfrost.
Sept. 13	Day	1.0	N. and N.E.	Very fine, but boisterous.
13-14	Night	1.0	N.N.W.	Fine during evening; dull and boisterous towards morning.

CASES OF MINIMUM OZONE—(*Continued.*)

Date.	Day or Night.	Amount.	Direction of Wind.	General State of the Weather.
1863.				
Sept. 25	Day	1.0	N. and N.E.	Fine, but boisterous.
28	,,	1.0	W. and N.W.	Fine, but cloudy and boisterous.
30-1	Night	1.0	E. and N.E.	Fine and clear; hazy.
Oct. 3-4	,,	1.0	S.E. and N.E.	Fine and clear, with heavy dew.
4	Day	1.0	N.N.E., S., and W.	Fine and cloudless.
4-5	Night	1.0	W. and N.E., light	Fine and clear, with heavy dew.
5	Day	1.0	N. and N.E.	Fine and clear.
6	,,	1.0	N. and N.E.	Boisterous and very warm; much dust.
10	,,	1.0	S.S.W., E., and v'ble	Fine and pleasant.
15	,,	1.0	E.N.E. and S.E., light	Fine; foggy.
16	,,	1.0	Ely. and S.	Very fine.
24-25	Night	1.0	Calm and Ely.	Fine and clear, with heavy dew.
25	Day	1.0	N.N.Ely.	Fine, but boisterous.
25-26	Night	1.0	N.N.E. and N.W.	Rain showers and distant thunder before midnight; heavy squalls towards morning.
Nov. 4-5	,,	0.5	E. and N.E.	Fine and mild, but dull.
16	Day	1.0	E.N.E. and Nly.	Fine, but oppressive; sharp gusts of wind and much dust.
21-22	Night	1.0	N.W. and S.	Fine.
23	Day	1.0	S.S.W. and S.W.	Fine and clear.
23-24	Night	0.5	S. in evening, N.E. towards morning	Fine and clear, with heavy dew.
24	Day	1.0	N.E. and N.	Fine and clear, and very hot.
24-25	Night	1.0	Nly.	Fine and clear, with heavy dew.
25	Day	1.0	N.Ely.	Dull and hot.
28-29	Night	1.0	S.E. and N., light	Fine and clear, with heavy dew.
Dec. 5-6	,,	1.0	W. and N., light	Fine; close and sultry towards morning with thunder towards E.
6-7	,,	1.0	Calm and N.E.	Fine; heavy rain shower at 2 a.m.; close and sultry towards morning.
7-8	,,	1.0	N.E. and N.	Fine and very close; dense fog towards morning.
9	Day	1.0	S.W. and S.E., light	Fine; dense haze all round.
19-20	Night	1.0	Calm and Nly., light	Very fine and clear, with heavy dew.
20 21	,,	1.0	S.E. and N.E., light	Very fine and clear, with heavy dew.
21	Day	1.0	Variable and light	Fine and very hot.
21-22	Night	1.0	Calm during evening, S.W. tow'ds morn'g	With slight dew.
22-23	,,	1.0	S.E. during evening, N.E. tow'ds morn'g	Fine and pleasant.
29	Day	0.0	Nly.	Hot and boisterous, and much dust.
29-30	Night	1.0	Nly.	Fine; light gusts of wind.
1864.				
Jan. 2-3	,,	1.0	S.E. during evening, N.E. tow'ds morn'g	Fine and clear, with heavy dew.
4	Day	1.0	Sly.	Very fine; evening close; sheet lightning from all points of the compass.
4-5	Night	1.0	S.E. during evening, variable afterwards	Close and sultry; rain showers early in the morning.
6	Day	1.0	S.W. and Sly.	Very fine; hazy all round.
7	,,	1.0	S.E. and Sly.	Very fine and pleasant.
7-8	Night	1.0	S.E. during evening, N.E. tow'ds morn'g	Fine, with heavy dew.
8	Day	0.0	N. and N.E.	Fine; very hot and sultry.
17-18	Night	1.0	S.E. during evening, N.E. tow'ds morn'g	Fine, with light dew.
18	Day	0.0	N.E. and E.N.E.	Fine and very hot.
18-19	Night	1.0	N.Ely.	Fine, and close and sultry.
21	Day	1.0	S.W., S., and E.S.E.	Fine and clear.
25	,,	1.0	N.W. and S.S.E.	Fine and very hot.
27	,,	1.0	W. and S.W.	Dull, but pleasant; threatening sky.
29-30	Night	1.0	S.E. during evening, N.E. tow'ds morn'g	Fine, and heavy dew.
30	Day	1.0	S.E. and S.	Fine and clear.

CASES OF MINIMUM OZONE – (*Continued*)

Date.	Day or Night.	Amount.	Direction of Wind.	General State of the Weather.
1864.				
Jan. 30-31	Night	1.0	Calm, and N.N.E. towards morning	Fine and clear, with heavy dew.
Feb. 1	Day	0.0	S., S.S.W., and calm	Very fine, with a strong, cool breeze.
5	,,	1.0	S. and S.E.	Fine and pleasant; very hazy.
14	,,	1.0	S.E. and S.S.W.	Very fine and clear.
14-15	Night	1.0	S.E. during evening, N.E. tow'ds morn'g	Fine and clear, with heavy dew.
15	Day	1.0	Ely. and S.S.W.	Very fine and clear.
15-16	Night	1.0	E.	Fine and clear, with heavy dew (earthquake at 2 a.m).
16	Day	0.0	N. and E.	Close and sultry.
16-17	Night	1.0	Calm and N.E.	Close and sultry and cloudy.
17	Day	1 0	N. and N.N.E.	Boisterous and very hot; sheet lightning in S.E. and S.W. during evening.
17-18	Night	1.0	N.N.E. and N.N.W.	Cloudy and squally; rain squalls at 6.30 a.m.
21	Day	0.0	S.S.W. and S.E.	Fine, but cloudy.
28-29	Night	0.5	E. and N.E.	Fine, with heavy dew during the night.
Mar. 1-2	,,	0·0	E.	Cloudy, and close and sultry towards morning.
7-8	,,	1.0	E.S.E. and E.	Fine and clear, with heavy dew.
8-9	,,	1.0	Variable and light	Fine and clear, with heavy dew.
9-10	,,	1.0	Variable and light	Fine, with dew.
10	Day	1.0	Ely. and N.	Dull and threatening and sultry.
10-11	Night	1.0	E. and N.E.	Close and sultry.
11	Day	0.0	N. and N.N.E.	Close and sultry; very hot afternoon, and threatening sky.
13-14	Night	1.0	Variable d'ng even'g, N. tow'ds morning	Fine and clear; very squally.
23-24	,,	1.0	Calm during evening, N.E. tow'ds morn'g	Fine and clear, with heavy dew.
24	Day	0.0	N.N.E.	Very hot; fine in the morning; at 3 o'clock, rain in S.W., thunder in same direction; at 4 o'clock, wind round to S.W., with heavy squalls and dense clouds of dust; at 5 o'clock, back again to N.N.E.
24-25	Night	1.0	N.E. during evening, S.W. in morning	Fine and clear.
28	Day	1.0	Variable and light	Fine and very hot.
28-29	Night	1.0	E. and N.	Fine and clear, with heavy dew.
29-30	,,	0.0	Calm and N.E.	Fine and clear.
31	Day	0.0	Nly. and E.S.E.	Fine and very hot; scattered rain at 6 p.m.; sheet lightning in evening.
April 11	,,	0.0	E. and N.E.	Very fine and clear.
11-12	Night	1.0	E. and N.E.	Fine and clear, with heavy dew.
18-19	,,	1.0	Ely.	Fineand clear, with heavy dew.
19-20	,,	1.0	Calm	Fine evening; heavy dew in the night; dark and gloomy towards morning.

CASES OF MAXIMUM OZONE,

Registered during 12 *hours' exposure, with attendant State of the Weather.*

Date.	Day or Night	Amount.	Direction of Wind.	General State of the Weather.
1863.				
Jan. 13-14	Night	10.0	S.W. tow'ds Midnight	Veering round to N.E., with steady rain.
23	Day	8.0	S. and S.S.W.	Thunderstorm during the evening.
24-25	Night	8.0	Calm	Constant steady rain and sheet lightning.
25-26	,,	10.0	Westerly squalls	Misty rain occasionally.
Feb. 2-3	,,	8.0	Sly.	Heavy lightning and distant thunder, scattered drops of rain.
7-8	,,	7.0	Sly., very light	Overcast sky.
17	Day	9.0	Sly.	Steady rain.
17-18	Night	10.0	Sly.	Steady rain.
18	Day	10.0	Sly.	Steady rain and strong squalls.
18-19	Night	10.0	Sly.	Heavy rain.
20	Day	10.0	S.W.	Misty rain.
26-27	Night	10.0	S.W.	Very strong.
27-28	,,	8.0	S.W.	Very strong, frequent sheet lightning.
Mar. 6-7	,,	8 0	S. and S.W.	Frequent sheet lightning.
11	Day	8.0	S.W.	Scattered rain.
15	,,	8.0	E.S.E. and S.E.	Light rain.
18	,,	8.0	Wly.	Heavy rain.
April 1	,,	8.0	N.Wly.	With thunderclouds and occasional rain showers.
5	,,	9.0	E.S.E. and S.	Misty rain.
19	,,	9.0	S.W. and calm	Very fine and clear.
24	,,	9.0	N. and W.	Heavy rain, with lightning.
24-25	Night	9.0	W.	Dull.
26	Day	9.0	Wly., S., and N.W.	Fine and clear.
May 3	,,	8.0	W. and N.N.W.	Light rain.
16-17	Night	8.0	S.E. and calm	Steady rain.
20-21	,,	8.0	N. and N.W.	Steady rain.
22-23	,,	9.0	Nly.	Fine weather.
June 5-6	,,	9.0	Nly.	Light rain
6	Day	9 0	Nly.	Light rain.
9	,,	9.0	Sly.	Squally, and misty rain.
14-15	Night	9.0	S.W. and S.	Dense fog towards morning.
23-24	,,	8.0	N.N.E.	Fine.
24	Day	8.0	W. and N.	Heavy rain.
July 6-7	Night	10.0	Sly.	With smart rain.
13-14	,,	10.0	S.W.	Occasional rain showers.
16-17	,,	10.0	S.W. and W.	Drizzling rain.
25	Day	8.0	N.N.W.	Fine.
30-1	Night	9.0	N. and Wly.	Boisterous ; thunderstorm, with rain and frequent lightning all night.
Aug. 1	Day	9.0	N.N.W. and W.S.W.	Strong gale, with rain squalls.
2	,,	10.0	W. and S.W.	Squally, with rain and hail.
2-3	Night	10.0	S.W.	Squally, with rain and hail.
3	Day	10.0	S W. and S.	Squally and showery.
4	,,	10.0	W.S.W. and S.W.	Squally and showery.
4-5	Night	10.0	W.S.W.	Squally and showery.
8	Day	10.0	N.W. and W.N.W.	Squally and showery.
17	,,	9.0	N.N.E.	Gloomy and showery.
18	,,	10.0	N. and E.	Showery and unsettled ; heavy thunder-clouds.
22	,,	10.0	W. and S.W.	Showery and unsettled.
26	,,	10.0	N. and N.N.W.	Boisterous and threatening ; rain and hail towards evening.
27	,,	9.0	N. and N.N.E.	Showery and squally.
Sept. 1	,,	10.0	N.	Heavy thunderclouds ; rain showers.
2-3	Night	10.0	S.W.	Showery.
3	Day	10.0	S. and S.W.	Showery and unsettled ; heavy low clouds.
10	,,	10.0	W. and S W.	Boisterous and squally ; light rain.
16-17	Night	10.0	S.W.	Rather dull and squally.
21	Day	10.0	S.W. and S.	Boisterous, and steady rain.
21-22	Night	10.0	S. and S .W	Boisterous, and steady rain.
Oct. 7	Day	10.0	S. and S.W.	Steady rain and heavy squalls.

CASES OF MAXIMUM OZONE—(*Continued.*)

Date.	Day or Night.	Amount.	Direction of Wind.	General State of the Weather.
1863.				
Oct. 12	Day	9.0	S. and S.E.	Dull, with gentle rain.
12-13	Night	10.0	S.	Incessant rain and heavy squalls.
13	Day	10.0	S. and E.	Squally and showery.
13-14	Night	10.0	W.S.W. and S.S.W.	Heavy rain.
17	Day	10.0	S.W. and W.N.W.	Incessant rain, with sharp squalls.
18-19	Night	10.0	W.S W. and N.W.	Unsettled, and rain squalls.
Nov. 1	Day	10.0	S.W. and W.S.W.	Heavy squalls, with rain and hail.
1-2	Night	10.0	S.W. and W.S.W.	Heavy squalls, with rain and hail.
2	Day	10.0	S.W.	Frequent rain squalls, with hail.
10	,,	9.0	S.W.	Fine and clear.
22	,,	10.0	S.W.	Violent squalls and heavy rain.
26	,,	10 0	S.W.	Rain, with little intermission.
27-28	Night	10.0	S.E. and E.	Fine and clear.
Dec. 10-11	,,	9.0	S.W.	Fine and mild, but cloudy.
13-14	,,	10.0	S.E. and S.W.	Heavy thunderclouds, with rain and violent squalls.
16	Day & Night	10.0	S W.	Squally and heavy rain.
1864.				
Jan. 9-10	Night	10.0	S.W.	Heavy rain showers.
26	Day	7.0	W.S.W.	Boisterous and showery.
Feb. 7	,,	10.0	N.W. and S.	Close and sultry, followed by heavy rain and thunder and lightning.
7-8	Night	10.0	W.S.W.	Boisterous and squally, with heavy rain showers.
8	Day	8.0	W.S.W.	Squally and misty rain.
23	,,	9.0	W.S.W. and S.	Fine and cold, but cloudy.
25	,,	8.0	S.W. and S.	Very fine and clear.
Mar. 2	,,	8.0	Sly.	Close and sultry, followed by a thunder-storm and heavy rainfall.
19	,,	10.0	S. and S.S.W.	Dull and squally.
25	,,	8.0	S.W. and S.E	Fine, but cloudy.
April 2	,,	8.0	W. and N.N.E.	Threatening and close, with distant thunder; towards evening, lightning and heavy rain.
6	,,	8.0	N.E. and N.	Dull and threatening; thunder and lightning with rain in the afternoon.
7	,,	8.0	S.S.W. and S.E.	Fine, but very dull.
8-9	Night	9.0	S.E.	Squally and rain showers since midnight.
9-10	,,	9.0	N. and S.W.	Very gloomy.
15	Day	9.0	N. and S.W.	Dull and threatening, with heavy rain showers.
16	,,	8.0	S.W.	Cold, cloudy, and unsettled, with slight rain showers.
21-22	Night	8.0	N.E. and N.N.E.	Fine during evening; cloudy, with light rain after midnight.
23	Day	8.0	N.W. and W.	Showery and unsettled.
23-24	Night	8.0	N.W. and N.	Fine and clear during evening; cloudy, with rain, towards morning.
24	Day	10.0	N. and S.W.	Raw and unpleasant weather, with steady rain.
24-25	Night	9.0	S.W. and W.	Cloudy and squally, with light rain showers.
25	Day	10.0	W. and S.W.	Cold, boisterous, and showery, with hail.
26	,,	8.0	W S.W. and N.W.	Cloudy, but pleasant, occasionally light rain showers.
May 7-8	Night	8.0	N.E. and S.W.	Fine and clear during evening; dull and cloudy after midnight.
9	Day	9.0	W. and Sly.	Fine and pleasant, though cloudy.
10-11	Night	8.0	N.W.	Fine, clear, and cold, with heavy squalls.
13-14	,,	8.0	N.N.W. and calm	Rather cloudy; drizzling rain towards morning.

NOTE.—In the months of January and February, the Ozone papers were exposed
From 6 a.m. to 6 p.m. for day
,, 6 p.m. to 6 a.m. for night.
While in the remaining ten months they were exposed
From 9 a.m. to 9 p.m. for day.
,, 9 p.m. to 9 a.m. for night.